The Victorian Naturalist

Volume 135 (6) December 2018

Royal Botanic Gardens
Melbourne
-3 JAN 2019
LIBRARY

Published by The Field Naturalists Club of Victoria *since 1884*

From the Editors

With this issue we draw an end to another volume of *The Victorian Naturalist* and the 135th completed year of publication. This is no mean feat, particularly since it has been achieved from the beginning entirely through voluntary efforts. We don't mention this in order to gratuitously congratulate ourselves, but rather as an introduction to inviting readers to add to and enhance this contribution to the study of natural history.

We have observed in the past that this journal could not be produced successfully without the input we receive from people freely acting as referees, proofreaders and reviewers. This is still true but from time to time we need to add to our ranks of individuals who can be called upon to assist in these ways. If any of our readers would like to give up an occasional, small amount of time in order to aid a good cause, we would be pleased to add your name to our list, in any of these capacities.

We would be pleased, also, to hear from anybody with high resolution images that might be used as illustrations to accompany papers in the journal. As regular readers will know, the range of subjects covered in this publication is broad and occasionally it is hard to find appropriate pictures. Our aim is to have a pool of good quality images of the natural world on which we can draw, as the need arises. Of course, any images provided and used in this way will be properly ascribed and acknowledged.

The Victorian Naturalist
is published six times per year by the

Field Naturalists Club of Victoria Inc
Registered Office: FNCV, 1 Gardenia Street, Blackburn, Victoria 3130, Australia.
Postal Address: FNCV, PO Box 13, Blackburn, Victoria 3130, Australia.
Phone +61 (03) 9877 9860;
email: admin@fncv.org.au
www.fncv.org.au

Address correspondence to:
The Editors, *The Victorian Naturalist*, PO Box 13, Blackburn, Victoria 3130, Australia.
Phone: (03) 9877 9860. Email: vicnat@fncv.org.au

The opinions expressed in papers and book reviews published in *The Victorian Naturalist* are those of the authors and do not necessarily represent the views of the FNCV. Copyright of all original material published in *The Victorian Naturalist* remains with the author.

Yearly Subscription Rates – The Field Naturalists Club of Victoria Inc

Membership category

Single	$ 85	Institutional	
Family	$110	- within Australia	$170
Single Country/Concession	$ 64	- overseas	AUD183
Family Country/Concession	$ 85		
Junior	$ 51		
Junior additional	$ 17	Schools/Clubs	$94
Student	$ 38		

All subscription enquiries should be sent to:
FNCV, PO Box 13, Blackburn, Victoria 3130, Australia

Phone 61 3 9877 9860. Email: admin@fncv.org.au

The Victorian Naturalist

Volume 135 (6) 2018 December

Editors: Gary Presland, Maria Gibson, Sue Forster

Editorial Assistant: Virgil Hubregtse

ISSN 0042-5184

Front cover: Colony of Nodding Greenhood *Pterostylis nutans*. See page 171. Photo: Peter B Adams.
Back cover: *Phascolomys Wombat*, now Common Wombat *Vombatus ursinus*; drawing by HC Richter for John Gould, from *Gould's Ausrtralia: Selections from Mammals of Australia* (1977: 53).

Microfinance for environmental projects: the FNCV Environment Fund, 2003–2017

Barbara Burns
FNCV, PO Box 13, Blackburn, Victoria 3130
Email: barbgb@bigpond.com

Abstract
The FNCV Environment Fund was set up in 2003 to provide a means of funding small-scale environmental projects. To date more than $45 000 has been raised through tax-deductible donations, and 59 projects have been funded. Thirty-nine percent of grants went to activities associated with the FNCV, with the remaining 61% going to a wide variety of individuals and organisations, including university lecturers and students, local environment and friends groups and other field naturalist clubs. The Fund has been an excellent example of microfinancing. (*The Victorian Naturalist*, **135 (6)**, 2018, 160–170)

Keywords: project financing, tax-deductible funds, microfinance

Introduction

The Field Naturalists Club of Victoria (FNCV)'s Environment Fund is a little-known part of the Club's operations. The fund was set up in 2001 to support the Club's objectives in relation to the environment. The purposes of the Fund were written into the Club's constitution in July 2001 (FNCV Archive Series (AS) 200). The Fund was created specifically to support and fund:

- environmental research, particularly research into the biodiversity of Victoria;
- the dissemination of information on the natural environment by any legitimate means, including public lectures, seminars, field trips, courses and publications;
- practical projects aimed at preserving and enhancing the biodiversity of Victoria.

The Fund offers grants of between $200 and $1000 to facilitate small projects. The money dispersed is raised through donations, which are tax deductible to the donors. From 2003 to 2017, fifty-nine projects have been funded.

The Environment Fund is an example of 'microfinance' applied in the environmental area. It is an illustration of the notion that not all worthwhile projects require large amounts of money and that, sometimes, small sums can have important impacts, particularly when they go to non-professional, volunteer organisations and individuals.

The need for this type of microfinance is demonstrated by the steady stream of applications received. Unfortunately, not all worthwhile projects have been funded, due to the relatively small amount of money donated annually. This is a consequence of a limited pool of donors, consisting almost exclusively of FNCV members. It is hoped that by disseminating knowledge of the work of the Environment Fund to a wider audience through the pages of this journal, the pool of donors will be widened, resulting in an increased amount of money available for the projects.

The Fund

Creation of the Fund

The creation of an Environment Fund was first discussed within FNCV Council in May 1999, and arose in the context of amending the Club's constitution (AS 335). In the preceding July, the Club had received notification from the Department of Justice that the *Associations Incorporations Act 1981* had been amended and would require the Club's Constitution to be changed. In the succeeding months, FNCV Secretary Geoffrey Paterson tabled suggested amendments to the Constitution, in advance of presenting them to a General Meeting of the Club. However, Paterson resigned as Secretary in October 1998 before this presentation could be made; so at the Council meeting in the following month John Seebeck offered to complete the necessary changes (AS 302).

During discussions regarding constitutional change, Council also was considering the possibilities of improving its financial position by taking advantage of taxation benefits. The is-

sues of changing both the Club's constitution and its taxation status came together at a meeting on 23 February 1999. It was noted that to gain tax deductibility, appropriate changes to the constitution were necessary. Club Treasurer Arnis Dzedins proposed that a new clause (No. 7) be added to the Statement of Purposes, the thrust of which was 'to set up a public fund to be known as the 'FNCV Environment Fund' under the rules of the Club ...' (AS 335).

These changes were put to a Special General Meeting on 6 December 1999 and passed unanimously. Council's discussion regarding the setting up and operation of an Environment Fund ensued, and continued throughout 2000. At the February 2001 meeting, President Dr Tom May told Councillors that he had all the information and papers required, but not the time to fill in the application forms and other documentation (AS 336). Council member Dr Robert Rogers then offered to take on this task and get the fund established. By April 2001 all was in readiness and the proposed changes to the Club's Constitution, which were needed in order to set up a 'public' fund, were advertised to the FNCV membership in *Field Nats News* in June 2001. At a Special General Meeting of the Club on 1 July 2001 these were voted on and approved (FNN 99,102). A submission to the taxation office was made and, eventually, on 14 June 2002, the fund was listed on the Register of Environmental Organisations by the Federal Department of the Environment and Heritage (Commonwealth of Australia 2003). Although the process of creating a public fund with tax deductibility had taken three years, it was finally successful.

First meeting

One of the conditions of establishing a public fund was that there be a committee of management of at least five individuals. Rogers suggested that the President, Treasurer and Conservation Co-ordinator be *ex officio* members and others could be added as needed.

The first meeting of the committee took place on 12 February 2003, and was chaired by Dr Malcolm Calder (FNCV President 1993–1995). Other members in attendance included Dr Tom May (FNCV President 1998–2001), Anne Morton (Secretary), Barbara Burns (Treasurer), Dr Noel Schleiger, and Dr Robert Rogers. The minutes of that meeting record that it was called to determine the processes by which the fund would operate, and the type of projects it would consider (AS 468).

Initially, it was decided there should be two meetings per year. The first would be in December, 'to consider the financial status of the fund, design the final version of the application form and set ... dates'. The second meeting would be in April, to review the applications (AS 468).

In the following year, the December meeting was dropped as it was found that holding a single meeting in April was sufficient. Timelines established at the inaugural meeting were to circulate the request for grant applications in February and to announce the successful grants recipients in May at the FNCV Annual General Meeting. It was further decided that notice of the availability of grants and a request for donations would be published in the Club's monthly newsletter *Field Nats News*, as well as being placed on the FNCV website, and distributed to all Victorian field naturalist clubs.

The Fund's philosophy

Early on in the life of the fund, its developing philosophy aimed to differentiate it from government sources of grants and money available from corporations, large trusts or foundations. It was decided to make the grant application process as easy as possible by: requiring only a one- or two-page written submission (Appendix 1); ensuring a quick turnaround in assessing the application; speedily informing the applicant of their success or otherwise, and making sure that all money received was dispersed though grants. This last consideration was possible since all administrative work was to be carried out by volunteers, and any small charges, such as postage, were to be met from FNCV general funds.

In relation to the choice of projects to be funded, no hard-and-fast ranking criteria were laid down, but several points were noted in the early meetings. These included:

- a desire to cater for individuals in need of money for research, who are not professionals;
- to avoid sponsoring university personnel who already have access to other funding sources;

- as the Fund has been set up by the FNCV it 'should concentrate on applications that come from within the Club' (AS 468).

Funding

Over the 14 years of operation to 2017, a total of $45 414 has been received in donations, which is an average of $3240 per annum. Statistics submitted to the Register of Environmental Organisations in Canberra show that between 60 and 70 people donate per year, with amounts varying from $8 to $200. (Commonwealth of Australia, Department of the Environment and Energy (DEE) 2003). Almost all donors are members of the FNCV, who donate when they return their membership renewal form, which includes a box allowing donations to be added to the annual subscription. It is notable that donations decreased by about $1000 per annum when it became common for membership renewals to be made online rather than by returning the paper form through the mail.

Safeguards

Part of the reason Tax Deductible status is difficult to achieve is that Government awards the right for donations to be subsidised through a deduction from tax revenue. To ensure that this privilege is not misused, all organisations on the Register of Environmental Organisations are required to complete an annual statistical return that lists donations, grants and the environmental outcome of each grant. (DEE 2003).

To safeguard against the misuse of donations, internal procedures in the management of the Fund were set up to follow good accounting practices. These include not paying the grant upfront to successful applicants but instead requiring them to submit invoices to the FNCV office for reimbursement.

Applications made and grants awarded

Table 1 shows that from 2003 to 2017 a total of 79 applications for grants were made, with 26 (33%) coming from the FNCV itself, and 53 (67%) from other individuals and organisations. Applications were spread fairly evenly over the period.

Grants to the FNCV

Of the 59 successful grants, 23 (39%) were awarded to the FNCV, with the remaining 36 (61%) obtained by a wide variety of individuals and community organisations. Of the 20 unsuccessful applications, only 3 (15%) were from the FNCV (Table 1).

Successful FNCV grants

Table 2 gives a breakdown of the 23 successful FNCV grants. Over the study period, a total of

Table 1. Environment Fund applications, and grants awarded, 2003–2017.

Year	Total Applications	Grants			
		Successful		Unsuccessful	
		FNCV	Non-FNCV	FNCV	Non-FNCV
2003	9	3	4		2
2004	2	1	1		
2005	6	1	1		4
2006	6	4			2
2007	3	2	1		
2008	6	1	3		1
2009	7	2	3	1	2
2010	5	3	1		1
2011	4	1	3		
2012	6	2	3		1
2013	4	1	3		
2014	7	1	4		2
2015	6		3	2	1
2016	5	1	3		1
2017	3		3		
Subtotal		**23**	**36**	**3**	**17**
Total	**79**	**59**		**20**	

$14 193 was paid out to groups and individuals that were part of the FNCV. Perusal of the sums granted shows they ranged from $188 to $1000 per project.

Grants to the FNCV Special Interest Groups

The bulk of the 23 successful Club grants (20) went to the Special Interest Groups (SIGs), with three going to other areas of the Club. All the SIGs, apart from the Day Group and Microscopy, have participated; several, including Botany and Fauna Survey, have obtained multiple grants.

All the FNCV SIGs, with the exception of the Day Group, run programs of fieldwork in addition to monthly meetings. For example, the Fauna Survey Group (FSG) is involved in long-term programs of monitoring the endangered Leadbeater's Possum in the central forests of Victoria, and the Brush-tailed Phascogale in Rushworth forest. The FSG also carries out surveys at many other locations. Among the projects undertaken in 2016 were four stag-watches for Leadbeater's Possum, three trips to Rushworth for nest-box checking, two reptile surveys in parks to Melbourne's east (in conjunction with Parks Victoria), two at Parker River in the Otway Ranges, and one at Annuello. In addition, other work was undertaken for the Shire of Cardinia and the City of Melbourne (FNCV Annual Report 2016).

Grants to the FNCV SIGs all had a common purpose, which was the purchase of equipment to assist with the groups' research and educational activities. Examples include:

- The Botany Group received $894 in 2008 to purchase weeding equipment to help in the maintenance of the Clyde Grasslands Reserve, a habitat of the endangered Maroon Leek Orchid;
- The Geology Group obtained $390 in 2006 to purchase geological maps;
- The Fungi Group, in 2006, purchased a Fowlers Vacola unit for $188, to be used for drying fungi specimens;
- The Marine Research Group, in 2008, applied for $1000 to purchase a portable microscope to assist with fieldwork; and
- The FNCV Juniors bought three stereoscopic dissecting microscopes in 2014, for $990.

The Fauna Survey Group has received the most money from the Environment Fund with 10 successful grants, totalling $6553 (Table 2). As with the other SIGs, this funding was used to purchase equipment, which included Elliot, cage and funnel traps; pit lines; bat traps; remote cameras; and spotlights. The FSG has

Table 2. Grants awarded to the FNCV, 2003–2017.

Applicants	No. of grants awarded to FNCV SIGs	No. of grants awarded to non-SIG areas of the FNCV	Total dollar value of grants paid to the FNCV($)
Special Interest Groups (SIGs)			
Botany	3		1315
Terrestrial Invertebrate	1		1000
Geology	2		390
Fungi	1		188
Fauna Survey (includes Bat Group)	10		6553
Marine Research	1		1000
Juniors	2		990
Non SIGS			
The Victorian Naturalist		2	1800
Dr Gary Presland, FNCV Archivist and Librarian		1	957
Subtotal	**20**	**3**	
Total		**23**	**14193**

not been able to meet all its needs for equipment from the relatively modest resources of the Environment Fund and in recent years has engaged in its own separate fund-raising activities.

The needs of the FNCV SIGs are generally small in monetary terms, as the work is done by volunteers who pay for their own petrol and camping costs. However, the examples above show the value of having a source of funding, such as the Environment Fund, where small amounts can be obtained relatively easily for modest but vital purchases.

Grants to non-SIG areas of the FNCV

Three grants have been awarded to non-SIG sections of the FNCV—two for the editorial team of *The Victorian Naturalist* and one to Dr Gary Presland, the Club's Archivist and Librarian (Table 2).

From its beginnings in 1884 through to 2005, *The Victorian Naturalist* was printed entirely in black and white. However, in 2006, the editors of the journal successfully applied for $800 to be put towards the inclusion of 16 pages of colour per issue. This was a valuable step in updating the publication, and helped improve the presentation of articles. The economics of printing were changing at that time and it soon became viable for the journal to be printed completely in colour.

In 2007 Gary Presland, who was also FNCV Secretary at the time, applied for a grant of $1000 to assist in creating a digital copy of as many volumes as possible of *The Victorian Naturalist*. Scanning took place over a period of eight months and resulted in the first 90 years of the publication being digitised. Subsequently, the first 70 of these volumes were burned on to DVDs and made available for purchase by the public.

In 2010, Presland successfully applied again for a grant, in this instance as the FNCV Librarian and Archivist. This grant, also of $1000, was put toward the costs incurred in recording and transcribing a series of interviews with longstanding FNCV members. He eventually claimed $957 of the grant. The compiled oral histories were used as a source of information in the writing of a history of the Club, which was published in 2016.

Unsuccessful FNCV applications

Three applications from the FNCV were not funded (Table 2). In 2009, an application by the Bat SIG for funding to stage a Bat Biodiversity Symposium did not go ahead because the Fund selection committee was aware of the fact that, since the submission, the SIG had been able to obtain funding from other sources. The other two non-funded applications were in 2015. One was for $350 for mulch and plants to restore and renew the native gardens surrounding the FNCV Hall in Gardenia Street, Blackburn. This application was dropped when Ian Moodie, a Whitehorse Council employee and member of the Fund committee, offered to arrange for the mulch to be obtained from the Whitehorse Council Depot supplies. The other non-funded application was for $554 for the purchase of a GPS for the FSG.

This application did not proceed as discussion at the meeting to award grants determined that FSG members preferred to use their own GPSs and that the two units currently owned by the group were sufficient.

Non-FNCV Grants

Fifty-three applications (67% of the total) came from a wide variety of non-FNCV entities. Of these, 36 were successful and 17 were unsuccessful (Table 1). It is notable that applications from outside the FNCV had a lower success rate (68%) than those from within the Club (88%).

Successful non-FNCV Grants

In Table 3 successful grant applications from outside the FNCV have been divided into five sub-categories: nature groups; university and TAFE academic staff; Masters and PhD students; field naturalists clubs other than the FNCV, and 'other', i.e. miscellaneous, uncategorised applicants.

Nature groups

Table 3 shows that the largest number of successful non-FNCV applications, 13 (36%), went to nature groups, including 'friends of', local nature groups and Landcare groups. University and TAFE staff obtained six grants (17%), with the two categories—'university students' and 'other field naturalists clubs'—each receiving six (17%) of the non-FNCV grants. The remaining five went to the 'other' category.

Organisations outside the FNCV were granted funding for a variety of projects, although, as was the case with grants to the FNCV, the predominant purpose was the purchase of equipment. In the 'nature groups' category, 13 entities received a total of $7485 over the study period, in grants that ranged from $200 to $1000. Among the organisations funded were:

- Friends of Warrandyte State Park (FOWSP), Mansfield Environment and Climate Action Group, Friends of the Helmeted Honeyeater, Friends of Leadbeater's Possum, Yarren Dheran Nature Reserve, and the VNPA, Nature Watch—'Caught on Camera'. All these groups asked for and received money to purchase computers, GPSs, a television (Yarren Dheran) and motion sensing cameras;
- Hughes Creek Catchment Collaborative received a grant of $1000 to assist with the employment of Jennifer Webb for 40 hours to investigate bandicoot populations, to speak at schools and to produce a leaflet on the Long-nosed Bandicoot *Perameles nasuta* and its habitat;
- Hillcrest Association, which is concerned with the conservation of the Mullum Mullum Valley, received $200 to fund information leaflets;
- Friends of Clematis Creek were granted $350 for platypus signage;
- Wildlife Victoria obtained $522 to buy flying fox rescue kits;
- Friends of the Box-Ironbark Forests were given $1000 as a contribution toward producing a field guide to the acacias of the Mt Alexander Region; and,
- The Binginwarri Landcare Group was granted $491 to assist in compiling a database of local indigenous species.

The author's favourite successful application in this category was that made by the group 'Mange Management', which uses the innovative 'Burrow Flap' method of treating mange in wombats. The method uses an ice-cream container lid, a bottle top which holds the treating chemical, Cydectin, and a wire frame. The wombat self-medicates when it leaves or returns to the burrow, by pushing past the flap, thus releasing a measure of the chemical (Fig. 1).

University and TAFE academic staff

The category that obtained the second largest amount of money was 'university and TAFE staff', which received six grants totalling $5047. Projects were diverse and included:

- $1326 to a La Trobe Botany Department staff member for two projects researching the recovery of plants in subalpine grasslands after fire;
- $894 for a Ballarat University lecturer to acquire bird bands and mist nets to undertake a survey of Birds in the Rural Living Zone;
- $885 in 2011 for Patrick-Jean Guay, Victoria University, to have a Pacific Black Duck *Anas superciliosa* and a Mallard *A. platyrhynchos* taxidermied, to be used in talks on the hybridisation of the two species;
- $1000, again to Patrick-Jean Guay, in 2013, towards satellite tracking of four Grey Teal *Anas gracilis* as part of an ongoing project which had been running for two and a half years; and
- $734 to Andrew Christie, a lecturer at Melbourne Polytechnic, to buy equipment to monitor the abundance of a marine pest, the European Fan Worm *Sabella spallanzanii* in Port Phillip Bay, to assess the efficacy

Table 3. Breakdown of non-FNCV grants awarded, 2003–2017.

	Successful applications		Value of successful grants ($)
Category of grant recipients	**Number**	**%**	
Nature groups	13	36	7485
University and TAFE academic staff	6	17	5047
University students	6	17	761
Other field naturalists clubs	6	17	5000
Other	5	13	6759
Total	**36**	**100**	**25052**

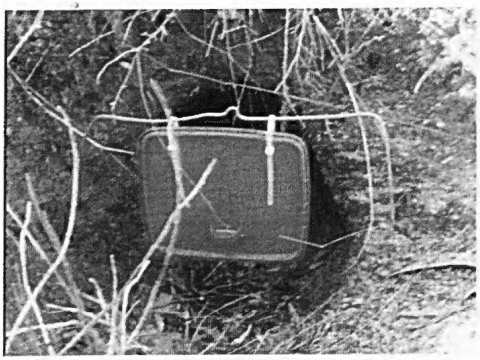


Fig. 1. Burrow Flap method of treating wombats. (Photo courtesy of Mange Management.)

of physical removal. Volunteers at Marine Care, Point Cook and students from the Polytechnic were to be involved in the project.

University students

Six grants totalling $2761 were paid out to this group. The money was dispersed to one PhD, three Masters and two Honours students for funding to buy or hire equipment to assist with research into:

- Swamp Antechinus *Antechinus minimus* (2003);
- native bees (2013);
- Koala *Phascolarctos cinereus* (2015);
- Smoky Mouse *Pseudomys fumeus* (2016);
- Round-leaf Pomaderris *Pomaderris vaccinii-folia* (2012); and
- fungi—defining the species boundaries of the genus *Laccaria* in Australasia (2017).

Other field naturalists clubs

- The Latrobe Valley (2005), Hamilton (2009), and Sale (2016) Field Naturalists Clubs each received grants of $1000 to assist with the printing of regional nature guides;
- Bairnsdale FNC (2016) was given $1000 for the purchase of three dissecting microscopes to be used by its newly formed junior's group;
- Casterton FNC (2003) received $1000 towards its Casterton Minnie Hole bird hide project; and
- Maryborough FNC (2012) was granted $1000 to purchase an electronic projector.

Other

Successful applications that did not fit into any of the above categories included:

- Ivanhoe Primary School (2009), $836 to purchase soil and mulch for the school garden;
- Christmas Hills Fire Brigade (2010), $280 for the purchase of plants to create a fire-smart landscape around the fire station; and,
- Dr Graeme Lorimer (2014), an independent botany researcher, who was granted $1000 to assist him in the compilation of an illustrated Identification Key for Victorian Stipoid Grasses, to be made available online.

Unsuccessful non-FNCV applications

As indicated above, there was a lower rate of success overall for the non-FNCV applications, compared to those from the FNCV (Table 1). This can be explained, in part, as a result of a guideline established early in the history of the Fund. Given that the Fund was set up, and is administered, by the FNCV, it was decided to give the highest priority to applications from within the Club itself.

Table 4 shows that 17 applications out of a total of 53 (33%) from non-FNCV applicants were not funded. The 'other' category had the highest level of rejections with 50% of their requests not successful. Next was the 'university and TAFE academic staff' group, with a 40% rejection rate, followed closely by 'local nature groups' with 35%. The lowest rejection rates were in the 'other field naturalists clubs' and 'university students' categories.

While specific factors meant some applications were not selected for funding, the fundamental reason for rejection can be traced back to the limited amount of money available for distribution. The minutes of Environment Fund Committee meetings do not record any applications that were deemed not to have met the funding criteria. With greater resources it is likely that most of the applications would have been funded. With a little over $3000 to distribute in a typical year, and in some years up to nine applications, hard choices had to be made by the grants committee as to which applications were the most deserving.

Over the 14-year study period, a high proportion of unsuccessful non-FNCV applications were from individuals rather than organisations. Possible reasons, which are not spelled out in any of the written documents, for deciding that lower priority was to be given to

individuals working alone, include a lack of monitoring and, in the case of trapping or nest boxes, the possibility that animal handling might occur without the necessary DELWP permits.

Further, a lower ranking of applications from individuals who were essentially intending to work on their own is in line with the selection principles set in the initial meetings of the fund. The need for support from an organisation is also mentioned on the application form as an essential requirement (FNCV website; Appendix 1).

Projects primarily rejected on this ground were generally included in the 'other' category, which had the highest rejection rate (Table 4).

Examples of this type of 'individual' application, which were not funded include:

- one from the owner of a Trust for Nature property in 2005, who requested $957 to purchase Elliot traps to be used on his own property;
- two applications in 2009: (1) from an individual to fence 150 acres of his private bushland in the Otway; (2) another to undertake a private search for the Tasmanian Tiger *Thylacine cynocephalus*; and
- one from an applicant in 2015, who wanted to install nest boxes on his private bush block in the Otways.

In 2003, the first year of the Fund's operation, a decision was made not to fund two applications (Table 1). These were among multiple applications submitted by one individual, a lecturer from the Botany Department of La Trobe University. There was not sufficient money to fund all nine of the applications received; so, to be fair to other applicants, it was decided to spread the money as widely as possible and approve only two of the four submitted by this individual. In the following year the fund rules were changed to avoid this situation occurring again. A note was inserted in the application form to discourage multiple applications from any single individual.

With some outside applications that did not succeed, it is harder to find a specific reason. On reflection, it seems to come down to competition with other applications in that year. Factors that tipped the balance were the quality of the application, whether the applicant was known to the committee, the possibility of the contender receiving funding from other sources and the strength of the likely environmental outcome.

An example of these harder-to-categorise applications is one from the Pyalong Restoration Group, which asked for $1000 to go towards a 12-month sponsorship of a page in the local monthly magazine 'Up the Creek'. This was rejected in 2005 and again in 2006, when it was resubmitted, the primary reason being the lack of a specific environmental outcome.

An illustration of the hard choices that had to be made occured in 2008. Six applications for grants were received, totalling $5644, but only about $4000 was available for distribution. Two applications from the FNCV Marine and the Botany Special Interest Groups, were funded to a total of $1894, leaving $2106 for non-FNCV requests. It was reluctantly resolved not to fund a project for an Indigenous heritage trail at St Kilda beach as it was decided that this initiative had a chance of being funded from other sources, whereas this was much less likely for the competing applications.

Likewise, in 2005 six applications were received, totalling $5922, but only $2300 was available in donations in that year. The FNCV Fauna Survey Group was granted $1000

Table 4. Relative lack of success in securing grants by non-FNCV applicants, by category, 2003–2017.

Category	No. of applications	Unsuccessful	
		No.	%
Nature groups	20	7	35
University and TAFE academic staff	10	4	40
University students	6	0	0
Other field naturalists clubs	7	1	14
Other	10	5	50
Total	**53**	**17**	**33**

to purchase Elliott and cage traps, and the Latrobe Valley FNC was granted $1000 towards the printing and publication of a nature guide for the Latrobe region; four other outside requests for funding missed out, including one from Allansford Kindergarten in south-west Victoria, which requested $965 to construct a sensory display garden. This is in contrast to the success of a similar project in 2009, when more money was available and $836 was given to the Ivanhoe Primary School for the purchase of plants, soil, etc. for the school garden.

Another example of financial restraints causing worthwhile projects not to be funded is from 2006, when a request for $894 from a Ballarat University lecturer to acquire bird bands and mist nets to undertake a survey of Birds in the Rural Living Zone was rejected. However, upon resubmission in 2007, when only two other applications were received, the grant was approved.

Benefits to the FNCV from grant recipients

One of the conditions of obtaining a grant is that within twelve months recipients must submit a short report of how the money was spent. The report can be published by the FNCV in *The Victorian Naturalist* or in the Club's newsletter, *Field Nats News*. Successful applicants are also encouraged to communicate their results to the Club via articles, talks or field trips. A number of grant recipients have done this, including Masters and PhD students and University and TAFE lecturers. Thus, there has been a two-way benefit between the Club and the grant recipient, with the Club being enriched through information and contact with people and projects, of which it might otherwise not have been aware.

Feedback from successful grant recipients

On a number of occasions, successful recipients have provided feedback regarding the process and the results of their projects. The following are a few examples:

In 2016, funding of $460 to Phoebe Burns facilitated the purchase of rechargeable batteries and contributed to the purchase of a small PC laptop for use in downloading data from a remote weather station. Phoebe subsequently reported (Burns 2017, Fig. 2):

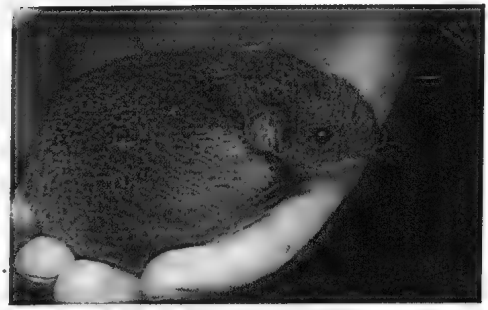


Fig. 2. Smoky Mouse. Photo: Phoebe Burns.

> The batteries were used in an identification trial comparing the suitability of infrared and white-flash cameras for smoky mouse surveys, and the influence of observer experience on identification accuracy. We found that observers are 20 times more likely to correctly identify smoky mice in white-flash images than infrared images, and that infrared cameras are particularly unsuitable for use in areas occupied by bush rats, as observers frequently confuse the two species. The manuscript is in review with *Australian Mammalogy* and the contribution of the FNCV Environment Fund is noted in the acknowledgements.

In 2012 the FSG applied for funding to purchase four Little Acorn cameras and associated equipment, for use in faunal surveys in a range of locations. Available funds allowed the Group to receive $568, which was the cost of purchasing two cameras. Robin Drury subsequently reported (Drury 2012), on behalf of FSG:

> The FSG purchased two Little Acorn remote cameras, taking its stock to six. Since then we have endeavoured to keep the cameras in the field, either associated with our own events or in conjunction with Parks Victoria. In the last 12 months, the cameras have been deployed at Mt Samaria, Dergholm, Rushworth, Baluk Willam, Mallacoota, Gobur, Seymour Bushland and Plenty Gorge. We have also commenced a large project with Parks Victoria in the parks of eastern Melbourne.
>
> A range of species have been detected. We predominantly take still images, but the video capability was used to monitor some of our nest-boxes at Rushworth, where some excellent videos of sugar gliders and a brush-tailed phascogale were taken. Overall in 2012 some 35 species have been recorded, including birds, bats, insects (butterfly) and mammals.

In 2012 the Environment Fund made a grant of $300 to update and reprint an education flyer titled 'Victoria's Bats'. This was an updated version of a brochure originally titled 'Melbourne's Bats', the printing of which was funded by the

Environment Fund. Megan Davidson, one of the applicants on behalf of the FNCV Bat Group, subsequently reported (Davidson 2013):

> The environmental importance of mega and microbats, coupled with the often negative press and widely-held misunderstandings about these animals, make public education on bats particularly important.

In 2016 the Bairnsdale and District Field Naturalists Club's Junior Field Naturalist Group was granted $1000 to purchase three microscopes. The Group later reported (AS 481, Fig. 3):

> The Bairnsdale and District Junior field naturalist group was launched in March 2016. A field trip to Fairy Dell ... for a fungi foray was ... our first time using the microscopes.
>
> The children were fascinated by the microscopic world. An eight year old was heard to say 'this is amazing' as she was looking at a lichen encrusted piece of bark, which also had small invertebrates living on it, which couldn't be seen with the naked eye. The microscopes are a wonderful scientific tool for the children; they are easy to use and are robust ...

Conclusion

The FNCV Environment Fund is an important initiative of the Club, which has made a valuable contribution over 14 years. Funding has been provided to 59 modest but significant projects, which have contributed to the study and preservation of the biodiversity of Victoria. It fills a niche in providing small amounts of money to individuals and local organisations that might otherwise struggle to find funding. It should be noted that 61% of the grants awarded over the past 14 years have been to individuals and organisations outside of the FNCV. The FNCV Environment Fund is not purely inward-looking; its value is much broader in scope.

One theme of this article has been the limited money available to the Fund. This has been a restriction to its ability to provide support for worthwhile projects. It would be a dream-come-true if the pool of donors could be widened. It is hoped that, through showcasing the variety and quality of projects and explaining the mode of operation of the Fund, that its work will be more appreciated, and a greater number of both FNCV members and non-members will see it as a worthy recipient of their support.

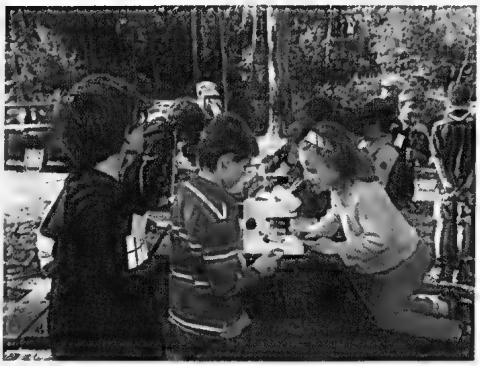


Fig. 3. Bairnsdale and District Field Naturalists Club juniors lining up to use the microscopes.

I would like to take this opportunity to sincerely thank those individuals who have regularly donated over the years and hope they will read this and gain an insight into the value of the contribution they have made.

Acknowledgements

I would like to thank Dr Gary Presland, who encouraged me to write this article and who provided invaluable assistance and support in its production.

References

Burns P (2017) Unpublished report to the FNCV Environment Fund (in AS 481).

Davidson M (2013) Unpublished report submitted to the FNCV Environment Fund (FNCV 477).

Commonwealth of Australia (2003) *Register of Environmental Organisations – Guidelines*. Electronic version. URL: 55.187.2.69/about/tax/reo/guidelines/index.html

Drury R (2012) Unpublished report to the FNCV Environment Fund (in AS 481).

Field Nats News, **99** (June 2001).

Field Nats News, **102** (September 2001).

FNCV Annual Report – 2016.

FNCV Archive Series 198: Minutes of Council Meetings 1991.

FNCV Archive Series 200: FNCV Constitution, 2001.

FNCV Archive Series 211: Minutes of Council Meetings 1992.

FNCV Archive Series 302: Minutes of Council Meetings 1998.

FNCV Archive Series 335: Minutes of Council Meetings.

FNCV Archive Series 336: Minutes of Council Meeting 2001.

FNCV Archive Series 468: FNCV Environment Fund, 2003.

FNCV Archive Series 477: FNCV Environment Fund, 2012.

FNCV Archive Series 481: FNCV Environment Fund, 2012.

Received 21 June 2018; accepted 19 August 2018

Appendix 1. Call for Applications to the FNCV Environment Fund (2017).

FNCV Environment Fund
Call for Grant Applications

The FNCV Environment Fund has the following purposes:

- To support and finance environmental research, in particular research into the biodiversity of Victoria;
- To support and finance dissemination of information on the natural environment by any legitimate means, including public lectures, seminars, field trips, courses and publications;
- To support and finance practical projects aimed at preserving and enhancing the biodiversity of Victoria.

The FNCV Environment Fund is administered by a committee consisting of Malcolm Calder (Chair), Barbara Burns (Secretary and Treasurer), Bob Rogers, John Harris, Ian Moodie and Cathy Willis.

The Committee calls for applications for the next round of funding from the FNCV Environment Fund. Requests for projects costing between $200 and $1000 will be considered.

Applications can be from organisations or individuals, but in the latter case must be supported by an organisation. Suitable organisations are established natural history or environmental organisations (Field Naturalist Clubs, Landcare Groups etc.), educational institutions or government departments. Multiple applications from one research group are not encouraged.

Applications for this round of funding close 31 March 2017. All applications will be acknowledged and results of applications communicated by 15 April 2017.

Grant money is required to be spent within 12 months of receipt of funding, with a report supplied on completion. The report can be published by FNCV and successful applicants are encouraged to also communicate the results of their project to the Club via articles, talks or field trips.

Please include the following information in the application:

- Project title
- Project description (max. 250 words)
- How the project meets the aims of the fund
- Budget (please include GST in all relevant items. Also indicate other sources of funding)
- Indicate if the application is from an individual or organisation
- Name of individual or organisation
- Applicant name and contact details (including mailing address/phone/fax/email)
- Signature of applicant
- Endorsement of organisation (signature of responsible person such as President, Secretary, Manager, Head of Department; include name and position held).

Applications should be sent to:

Secretary FNCV Environment Fund
Field Naturalists Club of Victoria,
PO Box 13,
Blackburn Vic 3130
or emailed to admin@fncv.org.au

Destructive effect of fire on terrestrial orchid populations at Warrandyte, Victoria

Peter B Adams

School of Biosciences, The University of Melbourne;
National Herbarium of Victoria, Royal Botanic Gardens, Melbourne
Email: gallangowan@optusnet.com.au

Abstract
There has been a marked reduction in diversity and overall number of terrestrial orchids in the residual area of dry sclerophyll forest of Tindals Wildflower Reserve over the past 40 years. Prescribed burning in 2006 destroyed the ground layer of herbs, grasses and moss beds with almost total destruction of terrestrial plants in that area—only a few scattered plants remained of four common species, including the Maroon Hood orchid *Pterostylis pedunculata*. Regeneration is very slow, particularly in dry years, and significant appearance of small seedlings and associated moss was not observed until ten years after the 2006 burn. *Pterostylis pedunculata* was the first to flower in the regenerating area, 11 years after the burn. Animal, human and bird disturbance contribute to the difficulties in sustaining orchid populations in a small reserve. Deliberate burning should be avoided in such small and fragile reserves on skeletal soils. (*The Victorian Naturalist*, 135 (6), 2018, 171–177)

Keywords: terrestrial orchids, fire, management, regeneration, Warrandyte

Introduction

Fire is an influential and destabilising factor in Australian ecosystems, particularly for orchids with high dependence on associated plants and microclimate. Growth and flowering of terrestrial orchids may be unaffected or depressed after fire, enhanced with synchronised flowering, or fire dependent, e.g. some species of *Diuris*, *Caladenia*, *Eriochilus*, *Microtis* and *Lyperanthus* (Dixon 1996). Responses are complex and site dependent, with different effects related to the intensity and frequency of burns, and the soil type and depth. Floral displays after fire may be impressive where there is relatively deep sandy soil: for example, Anglesea in Victoria and south-eastern parts of Western Australia. This can lead to a misperception and popular view that fire is generally beneficial for orchids and, therefore, always useful in the management of nature reserves. There are few reported longer-term, detailed studies of the effects of fire on terrestrial orchid populations, and only brief references to species (Erickson 1965; Duncan 2013). There were significant decreases in the numbers of some terrestrial species and increased growth and flowering of others after fire at Kinglake, Victoria (Barnett 1984).

My observations are from 1960 to 2017. In this more than 50-year observational study of Tindals Wildflower Reserve in Warrandyte, Victoria, the effects of planned burning on terrestrial orchid populations are reported.

The 2.6 ha reserve is 3 km south-west of the Warrandyte township, about 22 km east of Melbourne. It occupies the upper slopes of a hilltop bounded by Tindals Road and Warrandyte–Templestowe Road, and is an isolated patch of natural vegetation now surrounded by rural and residential development. The reserve supports a dry sclerophyll forest dominated by Yellow Box *Eucalyptus melliodora*, Red Box *E. polyanthemos*, and Bundy *E. goniocalyx*, on very skeletal soil overlying weathered Silurian mudstone sediments (Douglas and Ferguson 1976) (Fig. 1). The vegetation is sensitive, even to minimal disturbance, with erosion occurring after heavy rain, and it depends heavily on a significant undisturbed leaf layer. In 1990, 143 plant species, 115 indigenous (80%) and 28 introduced (20%), were listed for the reserve (McMahon *et al.* 1990). These included around 33 orchid species. Under 'Ecological Objectives' the report stated that prescribed fire will play an important role in maintaining and enhancing the ecological values of the reserve. In the first instance, fire is required for the control of Large Quaking-grass *Briza maxima*. The rationale for prescribed burning relates to concern by local residents that the vegetation in

Fig. 1. Edge of Tindals Wildflower Reserve, showing pink mudstone bedrock with shallow soils above.

the reserve increases the likelihood of property damage caused by uncontrolled fire.

Fire history of the reserve

Natural fire has not occurred in the reserve in the past 60 years (pers. obs.), despite several large and destructive fires in the local area in the 1960s. Deliberate burning has been used in autumn as a management tool, in rotating patches in 1992, 1997, 2002 and 2006, with an estimated 70% of the total area burnt over that time. The 2006 burn was moderately hot, destroying most of the litter layer and ground cover including mosses, grasses and herbaceous species.

Methods

Observations of the flora, and orchids in particular, have been made repeatedly since 1960 and findings are described below. Two areas are compared for orchid growth: areas unburnt since 1997 and an area burnt in 2006. Observations were made from June/July of 2012 until the end of February 2013 and from June/July 2013 until the end of February 2014 to encompass spring, summer and early autumn flowering. There are now large areas in this reserve with very few orchid species and only scattered colonies. The number of plants in 1 m × 1 m quadrats was recorded, selecting areas where the density of each species was greatest. The scatter of plants was too sparse to use larger quadrats or transect sampling.

Two measures were made for colony-forming species in both burnt and unburnt areas. One was where colonies were most abundant and dense, and another in less dense colonies that were more typical of the area. Non colony-forming species were very scattered and recorded in 1 m × 1 m quadrats where they were most abundant. Populations were surveyed from emergence of leaves and stems bearing flowers from June/July until the end of February to encompass spring, summer and early autumn flowering.

Nomenclature follows VicFlora (2015) except where otherwise indicated.

Results

General Observations 1960–2012

Over the period 1960–2012, the eucalypt dominants have reduced in number and density with progressive die-back and opening of the canopy. The original dry sclerophyll forest was described as woodland, a more open vegetation, in 1990 (McMahon *et al.* 1990), confirming that a loss of cover from the original vegetation had occurred.

Weed species, especially *Briza maxima*, have been prominent since the 1960s in some disturbed areas where rubbish was dumped and have increased in recent decades, along with exotic garden species. In areas unburnt for 20 years, the variety of native grasses, legumes, composites and other wildflower species has remained fairly constant. Some old roads and tracks have regenerated understorey and ground layers, with almost full coverage. In the patches burnt since 1992, *Cassinia* species and Golden Wattle *Acacia pycnantha* have developed a medium–tall shrub layer, larger in places and shading the ground; species diversity and the moss layer are much reduced here. There are no formal records available of species flowering for the period 1978–1990, before deliberate burning commenced, but my general observations indicate diversity similar to that reported in McMahon *et al.* (1990).

Most of the orchid species in the reserve were seen until the drought, with its drier summers, in the 1990s, after which there was a marked decline from 33 species to 12 species (Table 1). In particular, the mid-summer and autumn flowering species have been seen rarely, most not at all in the latter period. The areas adjacent to the reserve also were rich in orchids until urban development overtook them in the 1980s and 1990s.

Until 1980 there were large colonies, up to 20 m in diameter, of *Pterostylis curta*, *P. nutans* and *P. pedunculata*, as well as scattered *P. longifolia* and groups of *Glossodia*, *Caladenia*, *Diuris*, *Thelymitra* and *Microtis*. Maximum numbers were seen in July to October, followed by a few late spring–summer species including *Calochilus robertsonii*, *P. rufa* and *Dipodium punctatum*. In the past 10 years, only an occasional flowering plant of these species has been seen. The area of the reserve with the highest orchid density is now along the borders of an old track where fire has not destroyed the previously abundant moss beds.

Over the past 15 years, the size and number of *Pterostylis* colonies and total numbers of all orchids have progressively reduced. In particular, flowering *Caladenia* species have reduced from five to one species, *Diuris* from three to one species and *Glossodia major*, once common, has not been sighted. Nearly all of the species listed in Table 1 were recorded as abundant or common up to 1979, but now are rated as scattered, uncommon or absent.

In 1980, areas adjacent to the fenced reserve supported an intact ground layer of grasses and low plants, including most orchid species (Table 1). Orchid plants are now rare outside the fence. At west Warrandyte, fires result in extreme desiccation and death of terrestrial tubers in the shallow 2–6 cm topsoil (pers. obs.).

Area burnt prior to 2006

A ground layer of grass and moss is regenerating, and *Cassinia* and *Acacia* sp. persist, with die-back and general decline occurring 12–20

Table 1. Records of orchid species in Tindals Wildflower Reserve 1967–2017. *Nomenclature follows McMahon *et al.* (1990).

Orchid species recorded 1967–78	Common Name	Recorded 2012–15
*Acianthus exsertus**	Mosquito Orchid	
Caladenia carnea	Pink Fingers Caladenia	
Caladenia dilatata	Green-comb Spider Orchid	+
Caladenia gracilis	Musky Caladenia	
Caladenia praecox	Early Caladenia	
Calochilus robertsonii	Purplish Beard-orchid	
Corybas diemenicus	Stately Helmet-orchid	
Corybas incurvus	Helmet Orchid	
Cyanicula caerulea	Blue Caladenia	
Cyrtostylis reniformis	Gnat Orchid	
Dipodium punctatum	Hyacinth Orchid	+
*Diuris lanceolata**	Small Golden Moths	
Diuris orientis	Wallflower Orchid	
Diuris pardina	Leopard Orchid	+
Diuris × *palachila*	Donkey Orchid	
Diuris pardina	Leopard Orchid	
Diuris sulphurea	Tiger Orchid	
Eriochilus cucullatus	Parson's Bands	
Genoplesium despectans	Sharp Midge-orchid	
Glossodia major	Wax-lip Orchid	
Microtis unifolia	Common Onion-orchid	+
Pheladenia deformis	Bluebeard Caladenia	
Pterostylis sp. aff. alata	Striped Greenhood	+
Pterostylis curta	Blunt Greenhood	+
Pterostylis melagramma	Tall Greenhood	+
Pterostylis nana	Dwarf Greenhood	+
Pterostylis nutans	Nodding Greenhood	+
Pterostylis parviflora	Tiny Greenhood	+
Pterostylis pedunculata	Maroon Hood	+
Pterostylis plumosa	Bearded Greenhood	
Pterostylis revoluta	Autumn Greenhood	
Pterostylis rufa	Rusty-hood	
Thelymitra aristata	Great Sun-orchid	+
Thelymitra rubra	Salmon Sun-orchid	

years after fire. The commoner orchid species *P. curta*, *P. nutans*, *P. pedunculata*, *Diuris maculata* and *Thelymitra* species are scattered, with less dense colonies compared to the larger colonies that occurred prior to 1990.

Area burnt in 2006

The deliberate burn involved a rectangular area approximately 40 × 80 m from the apex of the hill, extending north towards the reserve entrance on the northern fence line. There is a scattered eucalypt overstorey and a shrub layer about 6 m tall, often with a complete canopy dominated by fire-stimulated *Cassina* sp. and Golden Wattle *Acacia pycnantha*. The grassy layer with moss, herbs, composites and legumes is almost completely absent and replaced by eucalypt and *Cassinia* litter. In places, bare burnt soil is still evident around tree bases, indicating that the fire was intense. There are a few scattered plants of Dusky Coral Pea *Kennedia rubicunda*, Grassland Cranesbill *Geranium retrorsum* and grasses.

Table. 2. Effects of fire on orchid populations in Tindals Wildflower Reserve (1 m survey squares).

Species 16/7/2012	Burnt area flowering	Burnt area non-flowering	Unburnt area flowering	Unburnt area non-flowering
Nodding Greenhood *Pterostylis nutans* Maximum density	0	0	126	310
Nodding Greenhood *Pterostylis nutans* Moderate density	0	0	37	70
Maroon Hood *Pterostylis pedunculata* Maximum density	4	10	49	142
Maroon Hood *Pterostylis pedunculata* Moderate density	0	2	13	24
Blunt Greenhood *Pterostylis curta* Maximum density	0	6	40	136
Blunt Greenhood *Pterostylis curta* Moderate density	–	–	3	12
Tall Greenhood *Pterostylis melagramma* Maximum density	0	2	11	4
Tall Greenhood *Pterostylis melagramma* Moderate density	–	–	6	3
Leopard Orchid *Diuris pardina*	0	0	6	0
Green-comb Spider Orchid *Caladenia dilatata*	0	0	5	1
Dwarf Greenhood *Pterostylis nana*	0	0	15	7

Comparison of orchid populations in burnt areas and areas unburnt since 1997

Orchid populations in unburnt areas (2012–17)

Pterostylis nutans is the dominant species in unburnt areas, with a maximum of over 400 individuals m^{-2} (Table 2). The other colonial *Pterostylis* species, *P. pedunculata* with 176 individuals m^{-2} and *P. curta* with 176 individuals m^{-2}, each had 30% of plants flowering. *Diuris* had 22 individuals m^{-2}. The more scattered *P. longifolia* had 15 individuals m^{-2}, most being in flower. *Microtis unifolia* occurred in very isolated colonies, 145 plants m^{-2} and not flowering. *Diuris pardina*, *Caladenia dilatata*, *Thelymitra aristata* and *Dipodium punctatum* were scattered in low numbers at ≤10 m^{-2}, most in flower. *Genoplesium despectans* was not found in the reserve. Most plants in the unburnt areas were associated with a dense moss bed or assemblage of grasses (Figs 2 and 3).

Orchid populations in areas burnt in 2006

In the burnt areas, only infrequent plants of *P. pedunculata*, *P. curta* and *P. melogramma* were found. *Pterostylis pedunculata* was the only species flowering, with a density of 4m^{-2} at one site only (Figs. 4–7). Plants were short and in poor condition, with small grey–green leaves in dry leaf litter, usually where moss was beginning to regenerate.

In the periods 2013–14, 2014–15 and 2015–16, general observations and estimates of numbers were made, with very similar results to those presented in Table 2. No flowering plants were seen in the area burnt in 2006. In 2016–17, specifically in August and September, there was significant regeneration of moss beds and scattered plants of *P. pedunculata*, *P. curta* and *P. nana* with only *P. pedunculata* in flower (six plants in total in 2016). There were scattered groups of very small *Pterostylis* seedlings in moss; these were not able to be identified to species level. More seedlings were found in 2017, and three plants of *P. pedunculata* flowered. No additional species were found.

Only 14 species were seen from 2012–16 compared with 33 recorded in 1967–78 (McMahon *et al.* 1990). This is a significant reduction which is not explained by seasonal variation.

Fig. 2. Colony of Nodding Greenhood *Pterostylis nutans*, unburnt area 2016.

Fig. 3. Common Onion-orchid *Microtis unifolia*, unburnt area September 2016.

Discussion

The effects of deliberate burning of Dry Sclerophyll Forest on orchid diversity and populations

Prescribed burning in 2006 and earlier has led to a marked decrease in the number of terrestrial orchid species, in both the total number of plants and the number of plants in flower. Barnett (1984) found a similar result in wet sclerophyll rainforest in Kinglake on deeper and moister clay soils. Following the Black Saturday fires, Duncan (2013) assessed the terrestrial orchids at Kinglake, Lake Mountain, Bunyip

Fig. 4. Regenerating moss clumps in burnt area, 2012 .

Fig. 6. Dwarf Greenhood *Pterostylis nana* rosette in regenerating burnt area, 2016.

Fig. 5. Greenhood *Pterostylis* sp. regenerating in moss bed in 2016, area burnt in 2006.

Fig. 7. Regenerating Greenhood *Pterostylis* sp.; plants excavated probably by White-winged Choughs.

and Wilsons Promontory, and found only a small number of species adversely affected. The species at Tindals Wildflower Reserve are different from Duncan's study apart from one, *P. longifolia*, and the soils are shallower and the rainfall lower. Duncan found that *P. longifolia* was not adversely affected by fire, unlike at Tindals Wildflower Reserve, where it was almost eliminated in burnt areas. In general, studies have indicated *Pterostylis* is not inhibited by fire on deeper soils (Backhouse and Jeanes 1995). The findings in this study indicate marked decline in genera and in all *Pterostylis* species and it is suggested that soil type and depth, and position of orchid tubers in relation to ground level are very important factors in responses to fire.

The observations in August and September 2016–17 indicate the return of significant numbers of seedlings and a few flowering plants of *P. pedunculata* 10–11 years after the 2006 burn. These may represent the spread of seed from flowering plants in the three unburnt adjacent areas. It is doubtful that regeneration was from tubers surviving over 10–11 dry seasons.

Compact clay soils retain heat longer than non-clay soils and temperatures are high near the surface, reaching 60°C at a depth of 7–8 cm (Beadle 1940), sufficient to explain the death of tubers at west Warrandyte. *Diuris* and *Pterostylis* generally have the largest tubers and are more likely to survive mild to moderate intensity fire. *Caladenia*, *Corybas*, *Glossodia* and *Acianthus* have smaller tubers and are less likely to survive fire. They have not been observed in the reserve for many years. Burns in the last 15 years are likely to have been hotter due to much drier conditions and greater build-up of leaf litter. Prolonged dryness after 2006 has contributed to poor regeneration of the moss beds, grasses and herbs necessary for orchid populations to thrive. The shading effects of fire-stimulated *Cassinia* and *Acacia* also may reduce regeneration.

There are other factors contributing to orchid decline, including grazing by rabbits, trampling

by foot traffic, and digging up of tubers by the White-winged Chough *Corcorax melanorhamphos* (pers. obs. 2012–14) (Fig. 7). There is no buffer zone of orchids around the fenced reserve to aid regeneration. In larger reserves such as Warrandyte State Park, with fewer burnt areas, the smaller species are still found.

Management implications

The long-term sustainability and management of small reserves in areas of residential development is difficult, and experienced rangers are pessimistic about their viability, particularly after a sequence of dry years (Cam Beardsell, pers. comm. 2014). The objectives of increased diversity and reduction and control of weed species for Tindals Wildflower Reserve (McMahon *et al.* 1990) have not been realised. Weed species such as *B. maxima* and exotic garden escapees, established for 40 years in parts of the reserve, are common and have not declined, despite the deliberate use of fire and hand weeding. Diversity of all strata, especially the ground layer and orchids, has been dramatically reduced.

The reserve has a relatively low fuel load due to the short stature of vegetation and low biomass associated with skeletal and poor soil. The small size of the reserve and relatively low biomass in relation to other areas of natural vegetation do not justify the fears of residents concerning increased fire risk. There has not been a major fire risk or significant fire in the past 60 years, in contrast with nearby areas. Fire has been very destructive to all orchids and many other species at this site, which has very shallow soil. Rotational prescribed burning since 2003 has contributed strongly to decline in all orchid species. To maintain residual colonies, deliberate burning should be avoided. Other management strategies such as manual removal of weed species, restriction of foot traffic to paths, and exclusion of rabbits are recommended.

Acknowledgements

Cam Beardsell discussed management issues of reserves. Millie Lee provided historical information regarding the reserve and its plants.

References

Backhouse G and Jeanes J (1995) *The Orchids of Victoria.* (The Miegunyah Press: Carlton, Victoria)

Barnett JM (1984) The Initial Effects of Fire on Orchids in Stringybark Box Forest. *The Victorian Naturalist* **101**, 188–190.

Beadle N (1940) Soil temperatures during forest fires and their effect on the survival of vegetation. *Journal of Ecology* **28**, 180–192.

Dixon K (1996) Influence of fire on management of Australian orchid habitats. In IUCN/SSC Orchid Specialist Group (1996) Orchids—Status Survey and Conservation Action Plan, p. 20. Eds E Hagslater and V Dumont (IUCN: Gland Switzerland and Cambridge, UK)

Douglas JG and Ferguson JA (eds.) (1976) *Geology of Victoria.* Geological Society of Australia. Special Publication No. 5.

Duncan M (2013) Response of orchids to the 2009 Black Saturday bushfires. *The Orchadian* **17**, 415–422.

Erickson R (1965) *Orchids of the west.* 2nd edn. (Paterson Brokensha: Perth)

McMahon ARG, Bedggood SE and Carr GW (1990) The vegetation and management of Tindals Road Wildflower Reserve, Warrandyte, Victoria. Ecological Horticulture Pty. Ltd., Report for the City of Doncaster and Templestowe, Clifton Hill, Victoria.

VicFlora (2015) Flora of Victoria, Royal Botanic Gardens Melbourne <http://data.rbg.vic.gov.au/vicflora>

Received 22 March 2018; accepted 27 September 2018

One Hundred Years Ago

THE GENUS PTEROSTYLIS
BY E.E. PESCOTT F.L.S., F.R.H.S.

... The method of the continuance each year of what may be called the parent plant is well known. When the vegetative growth appears from the tuber and pushes its way to the surface to grow the foliage, stem, and flower, it is enabled to do so by the plant food that was stored in the tuber by the work of the foliage of the previous year. As this store of food is slowly exhausted, the tuber gradually shrinks and shrivels until a mere skin remains. While growth is taking place, however, a small root is pushed out from the stem, just above the old tuber. From this quickly grows a new tuber, in which the growing foliage stores another food supply. When the flowering has been completed the plant slowly dies, leaving only a new tuber in the soil, the old one having disappeared and the skin having rotted away.

From *The Victorian Naturalist* **XXXIV**, p. 162, February 7, 1918

Historical reports of Common (Bare-nosed) Wombats *Vombatus ursinus* in the Warrnambool area, Victoria

The Common or Bare-nosed Wombat *Vombatus ursinus* was once widespread in south-eastern Australia, ranging from Mount Gambier and Murray Bridge in South Australia, through Victoria and New South Wales and into south-eastern Queensland (Troughton 1941). In Victoria it now occupies a range of habitats in hilly and mountainous regions (especially in East Gippsland, where it is common) and near the coast, but its distribution has declined. Thus, while it exists in Victoria in low numbers in the far south-west at Dergholm and Nelson (Menkhorst 1995), wombats are today almost completely absent in western Victoria. This contrasts with historical records indicating wombats were once found throughout the Volcanic Plains and the Otway Plains (Menkhorst 1995). Surprisingly, wombats are absent from the Otway Ranges and Menkhorst ascribes occasional sightings of them there to be the result of translocation by humans.

Common Wombats were declared vermin in Victoria in 1906 and a bounty was placed on their heads from 1925 to 1966. Seebeck (1984) noted thousands of bounty payments were made in the early years of the system, but bounties declined after the 1940s, presumably because of a reduction in numbers.

In this note, we describe some historical accounts of Common Wombats in Warrnambool and note how abundant they apparently once were in Warrnambool and its surrounding districts. The only local records in the *Atlas of Living Australia* for wombats are for skulls, skeletons and preserved specimens of unknown age.

Documented reports

An article on the 'History of Warrnambool' (Whitcombe 1929: 10) described Warrnambool in 1847 thus:

> In 1847 there was nothing but a cattle run and a great forest of trees and undergrowth sheltering a population of hundreds of aboriginals; and in the early 'fifties Warrnambool was but a scattered collection of bush tracks, full of wombat holes, with timber everywhere and mobs of kangaroos and emus to vary the society of the blackfellow.

Certainly, our documented reports suggest shooting wombats was quite common in the early days of European settlement of Warrnambool. Thus, in describing Warrnambool in 1847, Osburne (1887: 277–278) wrote:

> Warrnambool has always been celebrated for its fishing and shooting. In the olden time [*sic*] the beautiful scented groves of the myrtle (or box tree), stretching from the back of the hospital to the banks of the Merri, were filled with wallaby, kangaroo rats, brush kangaroo, native cats and wombats. The favourite haunt of the latter remarkable animal was between the mouth of the Hopkins and the east end of town. A great deal of the land there is sandy, with layers of limestone here and there, and afforded splendid cover for the wombat. Very large caverns caused by their burrows have been discovered in the course of excavations. The wombat is a very shy animal, is nocturnal, and as civilization has advanced, has almost disappeared from the suburbs. The author has seen some very large ones after they were slaughtered. He remembers hearing of one which weighed 3 cwt, and no doubt his old friend, Mr. E. Margetts, of the Savings Bank, who was and is a most enthusiastic sportsman, can bear him out in this assertion, for he was a great hunter of the wombat when they were so plentiful in Warrnambool.

An earlier newspaper report (Anon 1857: 2) referred to the aforementioned Mr E Margetts as a 'veteran wombat hunter'. However, not all wombats were shot for sport (Anon 1917: 2):

> Mr Alexander McKenzie, of Monanding, had an unpleasant experience with a wombat. In his sheep dog kennels he heard a furious barking at night, and when making an entrance was attacked by a large wombat which showed fight and bit him on the leg. Mr McKenzie locked the door, and secured a gun, he despatched [*sic*] the wombat after firing three shots. It was found that the animal had killed a valuable sheep dog.

Samuel Hannaford worked as an accountant in the Warrnambool branch of the Bank of Australasia from 1854 to 1863. He published his famous 'handbook' (Hannaford 1860) that includes a ramble (pages 22–23) along Pertobe lagoon, the Merri River mouth and

> … then ascending the track we clamber over the steep hill, passing by numerous deep holes, concealed almost by the thick bushes of the wild Raspberry, the Forget-me-not, and other of our indigenous plants; —they are the burrows of that uncouth creature, the Wombat, which is very numerous along the coast.

The steep hill described is thought to be at Granny's Grave. Hannaford went on to describe how a friend had reared young wombats, two of which were taken from the pouch of a mother wombat he had shot.

About the same time, James Bonwick, an Inspector of Schools and observant naturalist, described a field trip he took along the Hopkins River to Lake Gillear, then to Star Chamber (Starlight Cave) and the beach (Bonwick 1858: 65–66). He wrote:

> The sand which lies on the limestone and under the soil, or which fills up hollows in the rocks, is a famous resort for the Wombats. These pig headed, pig bodied and pig sized marsupials are fat, chu bby sort of creatures, keeping very bad hours, for they sport about at night, but affording a delicious supper for the Blacks, and not despicable to the palate of Whites. With their huge, blubbery carcase, it would hardly be believed that they are exceedingly nimble in action. I repeatedly watched them at moonlight feeding near their holes ... The Blacks send a boy into a Wombat hole to cause it to squeak, by which those above discover its whereabouts and then dig down upon it. In making a cutting at Warrnambool, the skeleton of a Wombat was found in a hole with the head of a spear sticking between its ribs.

In 1885, an article entitled 'Picturesque Victoria' (The Vagabond 1885) described how the Aborigines were:

> never very numerous, [but] the river provided them with plenty of fish, the bush with the kangaroo, the wallaby, the *kaola* [*sic*], and the *perro*. Wombats, fattest of marsupials, burrowed into the cliffs along the coast, and the sea shore provided shellfish for a change of diet.

Residents in 1857 complained about wombat burrows that were undermining the local roads (Anon 1857: 2).

Certainly, 20 years after Hannaford and Bonwick took their rambles in Warrnambool, wombats were becoming quite uncommon. Thus, in 1884 a note (Anon) in one of the local newspapers read:

> In the early days of the settlement along the western coast of Victoria wombats were very numerous, as evinced by the thousands of excavations (known as wombat-holes) round Warrnambool. The wombats are now seen very rarely in this district, but one was shot behind the hospital some weeks ago.

Urbanisation could also have reduced habitat for wombats in Warrnambool. In an 1894 article entitled 'Cutting up the Farnham Estate', Brunt (1894: 6) wrote about William Rutledge opening up land for sale east of Tower Hill and described what the country used to be like:

> The forest was heavy... the surface covered with a dense scrub in which the tree ferns attained a great height. It was home to the wombat and wallaby.

Even if wombats were declining rapidly in the 1880s in Warrnambool, their burrows were causing hazards (Anon 1887: 7):

> A man named William Morris was accidentally killed in the town common on Friday night last. At 5 o'clock he left Warrnambool the worse for drink, riding a draught horse with the intention of going home two miles distant. The horse was found without a rider, and on search being instituted the dead body of Morris was found on the common. Near it was a wombat hole, in which were marks of a horse stumbling.

Another newspaper report (Anon 1905: 8) of wombats concerned a property at Spring Creek, some 42 km due north of Warrnambool:

> While Mr. John Gilmour, of Winslow, and his son, Thomas Gilmour, were engaged in digging out rabbits on Mr. J. Good's property, 'Injemira', Spring Creek, on Saturday, they came across a wombat burrow, and after much hard work they captured a whole family of wombats. There were five full-grown animals, one of which the dogs killed, and another, a female with a young died. The young one did not long survive its mother. The other three, however, are alive, and Mr. Gilmour has offered them to the curator of the Zoological Gardens, Melbourne. Two of these wombats are about the size of well-grown baconers, and they should form an interesting addition to the collection of the Zoological Gardens.

'The Naturalist' (1915: 54) wrote a piece in the Melbourne newspaper *The Australasian* in 1915, in which he noted:

> In the early days the wombat was very plentiful in the south-west of Victoria. Around Warrnambool and westward away to Port Fairy, Yambuck and Portland their burrows could be counted by the score. In the sixties [*i.e. 1860s*] they were very plentiful and hundreds were killed. The wombat is no good to eat ... I have not heard of one being in the neighbourhood for many years and I fancy that the end must have come in the early eighties. Curiously enough the wombat seemed to have been content with the coast-line, and was rarely found at any great distance in land.

They seemed to survive around Portland much longer than in Warrnambool (BEC 1939: 3). Thus:

> We could easily start a miniature zoo at Portland, for within a few miles we have kangaroo, emus, wombats, phalangers, large and small, besides a good collection of birds.

Contemporary long-term district residents also describe early recollections of wombats—either their own memories or those of others.

Shirley Duffield believes the last known wombat in Warrnambool lived in Merrivale (a Warrnambool suburb) until 1954, while there had been an earlier report of a main street post supporting a roof over the footpath collapsing through wombat activity. She also believes a wombat road-kill was found in Scotts Creek (some 65 km east of Warrnambool) in 1994.

Confusing nomenclature

The terms used by writers of articles in historical times can cause confusion. Common names for animals vary greatly, depending on location and the period when the article was written. Thus, an article in the *Portland Guardian and Normandy General Advertiser*, published in 1856, referred to 'the valueless wombat opossum or native cat' (Anon 1856: 3). So a wombat opossum was a quoll—but whether the Spotted-tail Quoll *Dasyurus maculatus* or Eastern Quoll *D. viverrinus* is unknown. The '*perro*' mentioned earlier might be a potoroo, but we have no way of ascertaining the species of mammal to which the writer referred.

Another confusing term is 'wombat hole'. Several old newspaper reports used this term for sites for deposition of sewage or bodies (Anon 1890, Anon 1874 respectively). It seems that the term 'wombat hole' could refer not only to wombat burrows, but also to straight shafts caused by gases escaping through lava. The author of an 1888 article entitled 'A Trip to the Warrions' (Anon 1888: 10) described what were locally called wombat holes as the shafts for escaping gases, and noted that while wombats may well have previously used these holes at the Warrion Hills, there were now huge numbers of rabbits using them. As well, a note described how an Aborigine had been found buried in a 'wombat hole' (Anon 1860: 2). The body could either have been in a lava shaft or in an actual wombat burrow.

Conclusion

Common or Bare-nosed Wombats were certainly once common in Warrnambool. Before European settlement they apparently provided a valuable food source for Aborigines but were shot in large numbers by settlers, either for sport or for the perceived damage they caused. Habitat loss to urbanisation and rabbit overgrazing would also have reduced their numbers.

References

Anon (1856) A day in the bush. *Portland Guardian and Normandy General Advertiser*, 25 February 1856, 3.

Anon (1857) Untitled article. *Warrnambool Examiner*, 21 August 1857, 2.

Anon (1860). Untitled article. *Warrnambool Examiner*, 13 November 1860, 2.

Anon (1874) General news. *Hamilton Spectator*, 7 November 1874, 4.

Anon (1884) Untitled article. *Warrnambool Independent*, 22 May 1884, 1.

Anon (1887) Country news. *The Age*, 4 July 1887, 7.

Anon (1888) A Trip to the Warrions. No. 1. *Leader*, 15 September 1888, 10.

Anon (1890) Warrnambool. *Hamilton Spectator*, 5 April 1890, 4.

Anon (1905) Country news. *The Age*, 13 September 1905, 8.

Anon (1917) Untitled article. *Portland Guardian*, 19 January 1917, 2.

Atlas of Living Australia (ALA) https:/www.ala.org.au

BEC (1939) Nature notes. *Portland Guardian*, 20 November 1939, 3.

Bonwick J (1858) *Western Victoria. Its Geography, Geology and Social Condition. The Narrative of an Educational Tour in 1857.* (Thomas Brown: Geelong)

Brunt B (1894) Cutting up the Farnham Estate. *The Australasian*, 27 October 1894, 6.

Hannaford S (1860) *Sea and River-side Rambles in Victoria. A Handbook for those Seeking Recreation During the Summer Months* (Heath and Cordell: Geelong)

Menkhorst P (1995) *Mammals of Victoria. Distribution, Ecology and Conservation.* (Oxford University Press: Melbourne)

Osburne R (1887) *The History of Warrnambool, Capital of the Western Ports of Victoria, from 1887 up to the end of 1886* (Chronicle Printing and Publishing Co: Prahran)

Seebeck J (1984) Mammals of the plains or, where have all the wombats gone? In *The Western Plains—a Natural and Social History*, pp. 39–47 (Australian Institute of Agricultural Science: Melbourne)

The Naturalist (1915) The Wombat. *The Australasian*, 23 October 1915, 54.

The Vagabond (1885). Picturesque Victoria. About Warrnambool No. IV. *The Argus*, 3 January 1885, 4.

Troughton E (1941) *Furred Animals of Australia* (Angus & Robertson: Sydney)

Whitcombe F (1929) History of Warrnambool. Its rise and development. *The Weekly Times*, 24 August 1929, 10.

Robert Wallis[1,2]
[1]Office of the Deputy Vice-Chancellor (Research and Innovation), Federation University Australia, PO Box 663 Ballarat, Victoria 3353. Email: r.wallis@federation.edu.au
[2]Warrnambool Field Naturalists Club. Email: warrnamboolfnc@gmail.com

Elizabeth O'Callaghan
Warrnambool and District Historical Society. Email: info@warrnamboolhistory.org.au

Birds in their habitats: Journeys with a naturalist

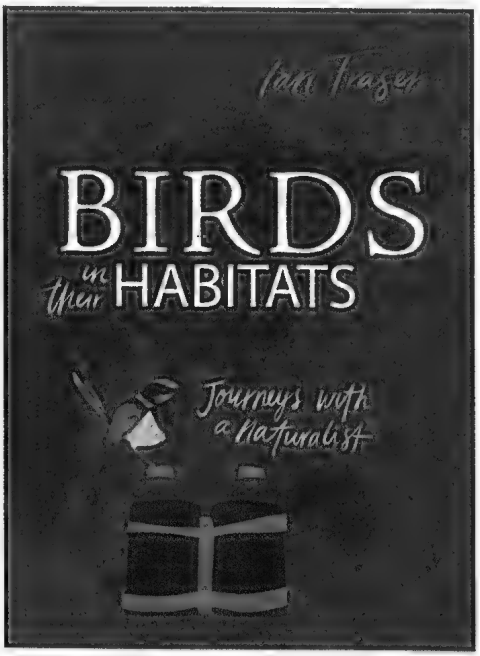
by Ian Fraser

Publisher: *CSIRO Publishing, Clayton South, Victoria, March 2018. 240 pages, paperback, colour photographs. ISBN: 9781486307449 RRP: $39.95*

This entertaining and often humorous book is written for bird-lovers and naturalists, for the most part in a conversational and self-deprecating style. Although described as a 'birding travelogue' on the publisher's website, it offers readers a great deal more.

The author, Ian Fraser, is a widely travelled natural raconteur. *Birds in their habitats* allows him to share his adventures in far-flung locations throughout the Southern Hemisphere while passing on to a bigger audience what he has learnt: specifically, how bird physiologies and behaviours have evolved in relation to changing habitats. Science aside, this achieves two important aims close to any birders' heart: it imparts valuable information about where to find exotic birds plus the optimum conditions for viewing them. However, as his title implies, Fraser's focus is on the journey rather than the destination; as a passionate natural historian he has little patience with 'twitchers' whose sole aim is to tick the next bird off their list. Embracing the First World privilege of travel and euphoria of discovery (pp. 29–30), he is expansive on the importance of looking 'for' rather than 'at' (p. 32).

Consistent with CSIRO's usual publishing format, Fraser's anecdotal field observations are supplemented by information boxes highlighted by background tone and a different font. Of course, these can be read independently from the travelogues/field observations, but their purpose and choice of information is sometimes puzzling as similar topics are given similar treatment in both formats (e.g. descriptions and explanations of male bird display). Although there are chatty digressions and occasional histrionics (such as the florid introductions to 'other memories' listed at the end of each chapter), Fraser's text is carefully referenced throughout, and his seven thematic bibliographies provide a good starting point for



further study. His deceptively light and intimate touch is backed by solid long-term research. FNCV members may even recall that he was awarded the Australian Natural History Medallion in 2006 for his 'services to conservation and education'. He is also known as a regular radio commentator and natural history tour guide.

In the tradition of natural history writer/ornithologist Graham Pizzey, Fraser has the old-fashioned skill of being able to 'paint' word pictures that bring drama to his subjects. Building on theatrical tradition, each chapter sets the stage for scenes acted out by his principals—himself and the birds he encounters, supported by fellow travellers, guides and researchers. While his humans inhabit a moral universe and are judged according to their sense of custodial responsibility for the environment, his birds occupy an alternative realm of science that is

subject to both fact and enchantment (think of Prospero's magical island viewed through an ecological lens).

Fraser's 'magical' island is constructed on a grander scale than that of Prospero; in addition to his spatial journeys, he has a strong sense of journeying through deep geological time and refers to himself as 'Gondwanan' (p. xii). The wildlife trips described in this book were all made over several decades in regions that once formed a large part of the Gondwanan super continent: Australia, Borneo, Chile, Ecuador, Peru, The Galapágos, Cameroon, South Africa and Uganda. Given that birds are descendents of dinosaurs, Gondwanan time-scale suits Fraser's narrative. While noting the evolutionary consequences of long-term cyclical climate change, Fraser also warns of the perils of short-term cycles (El Niño/La Niña) and recent global warming. He concludes that recent bird adaptations include diminished body size and colour changes as well as more widely observed changes in population size, distribution, migration and breeding cycles (Chapter 6).

In order of appearance, Fraser's seven key bird habitats are: deserts, rainforests, oceans and islands, mountains, wetlands and rivers, suburbia, and woodlands and grasslands. His journeys through these habitats are the catalyst for free-ranging discussions relating to the birds that inhabit them. His eclectic topics include: taxonomic revisions and common names; species diversification; island endemism and extinctions; migration and nomadism; diet, gut and bill specialisations; sense of smell; responses to overheating; body size and its effect on mobility; the aerodynamics of flight; the science of feather colouration; bird mythology; male bird display; predation and nest parasitism.

Fraser is particularly good at communicating the complexity of avian life in extreme climates. Take, for example, his analysis of the calculations made by 'zebbies' (Zebra Finches) in central Australia, that require up to 6000 grass seeds plus a constant water supply for daily survival, and must breed anywhere between four and twelve weeks after rain to feed seeds of the right consistency to their offspring (pp. 3–4). Also of note are intriguing stories about the brine shrimp-eating flamingos of the Atacama Desert, the bone-eating Lammergeiers of the Middle East, Central Asia and Africa, and the leaf-eating Hoatzins of the Amazon, to mention just a small sample on offer.

Fraser has amassed a great collection of stories that both fascinate and instruct. His panel on feather colours, for example, provides an interesting insight into bird physiology as well as colour perception. He explains that, in most birds, reds and greens are created by pigmentation derived from carotenoid-rich food and copper-based compounds, while blues are entirely reflected from tiny air particles embedded in colourless feather barbules (pp. 35–36). If this intrigues, readers may also wish to turn to the section on 'Wind soaring' to discover why the world's sole tropical albatross must nest on a tiny Galápagos island (a clue: its 'high aspect ratio' wings are too long to flap when taking off from the ground, p. 74). On a broader ecological note, Fraser also shares heart-warming stories about species and habitat preservation through eco-tourism initiatives in Peru and a soul-destroying anecdote about environmental destruction in the Cameroon.

Fraser acknowledges that he is a better writer than photographer, but it is still a pity that his 30 colour photos are reproduced as centre plates rather than located alongside his text. I presume this decision was due to budgetary constraints, but I can't help thinking that CSIRO's marketing department missed a good opportunity to launch this as a Christmas book with stronger design values and better illustrations and paper stock throughout. (It was actually launched in March this year). The book is obviously written for an international market. How many thousands of birders buy books worldwide?

Summarised by the author as his 'wonderings' about 'wandering' (p. xi), *Birds in their habitats* is written to reignite curiosity and rekindle our awe for natural history. It is designed to appeal to both the heart and intellect. Hover from cover to cover or peck into bite-sized portions as you go off to roost. Buy this genre-defying book as a present for your dearest friend, but borrow it back and cache it indefinitely. You will be rewarded by multiple readings.

Sue Forster
Editor, *The Victorian Naturalist*
c/- FNCV, PO Box 13,
Blackburn, Victoria 3130

A Guide to Native Bees of Australia

by Terry Houston

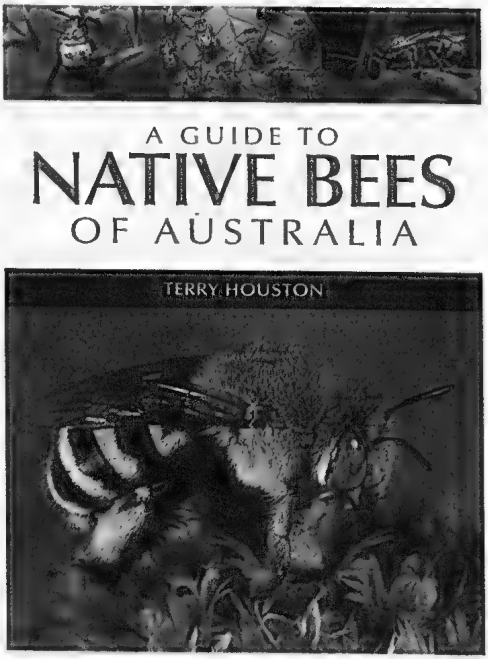
Publisher: *CSIRO Publishing, Clayton South, Victoria, 2018. 280 pages, paperback, colour photographs. ISBN 9781486304066. RRP $49.99*

In the past few years, there has been an amazing rush of Australian bee books. In 2016 there were two books published and in 2018 there already have been three new books on Australian bees. Which all goes to show the high level of public interest in the native bees of Australia.

However, while these publications have been excellent, they have been selective in the information provided. We all have been waiting for Terry Houston's book to provide a holistic, all-encompassing and detailed review of native Australian bees—and it has been worth the wait.

A Guide to the Native Bees of Australia is divided into two parts (Part 1: 87 pages; Part 2: 159 pages). Part 1 is titled 'Overview of bees and their biology' and is designed to introduce the reader to the morphology, evolution, behaviour and ecology of native Australian bees. Part 2 provides an in-depth, key-based identification guide to Australian bees as well as a wealth of information about members of each family.

I very much enjoyed reading Part 1. The chapter on Form and Function introduces the reader to what Terry calls the 'bee's tool-kit'. It provides an explanation for the many anatomical structures important to bee identification. Unlike many similar taxonomic character guides, Terry has included 12 images that are photographs of real body parts (e.g. head, body, mouthparts, legs, wings and male genitalia) rather than the usual line diagrams. The detail is absorbing and informative. Terry combines these images with discussion on separation of the sexes and functional use of body parts. A fundamental taxonomic and functional divide in all bees is whether they possess a 'short or long' tongue. These two tongue shapes are imaged and functionality ascribed to each tongue type. Terry then refers back to the uses of different tongue lengths through the remainder of the book.



Terry's interweaving of form and function provides the reader with an alternative means for bee identification using what is termed 'Traits analysis'. Rather than relying solely on morphological characters to effect an identification, bees can be identified through a range of ecological or behavioural traits that can lead to family or genus or even species names. For example, Terry explains that *Verticordia* plants have oily pollen held in place by a ring of hairs. Few bees can harvest this oily pollen except for species of *Euhesma*, which lick the pollen from the styles and then swallow it. Each species of *Verticordia* has its own specific species of *Euhesma*, so knowing the species of *Verticordia* will provide a species identification of its *Euhesma* bee visitor.

I have always said that Terry has a knack for finding bee nests when in reality it is his

combination of experience and patience that has delivered this ability. His intricate, experienced and detailed knowledge of the complex patterns of bee nesting across the five bee families will open up a new world of bee biology for many readers. Understanding can lead to appreciation, which, in turn, can lead to conservation. Leaving bare patches of earth in a garden or park is essential to provide bee nesting spaces.

Part 1 also includes sections on: Importance of native bees; Bee life cycles; Sexing bees; About males and mating; Stings; Colour patterns, mimicry and crypsis; Sociality; Nests and nesting behaviour; Cuckoo bees; Seasonality; Associated organisms; Conservation of bees; Historical account; and Collecting and preserving bees.

Part 2 is an identification guide to the five families and 58 genera of Australian native bees—although many of the common and unusual species are discussed and illustrated. A unique aspect of this book is the key to the five bee families as it is not in the usual dichotomous key format but rather is spread across two pages in a twelve characters by five family matrix. The benefit of such a character/family matrix is that readers can directly compare the same character across all five families at the same time. Readers can also choose the character(s) they are most comfortable and confident to use. Even getting to family level identification provides so much information about your bee.

The remainder of Part 2 goes through each of the five Australian bee families and provides taxonomic, dichotomous keys to all known bee genera except for the family Stenotritidae, which has only two easily distinguishable genera. Keys are based on Michener (2007) with some modifications.

Necessarily, to use these keys, users will need to be able to view the specimen under a microscope or hand lens and to have a good working knowledge of the morphological characters that were originally imaged and explained in Part 1. These keys are not for the faint hearted or the casual observer but, with experience and correct use, the identification of all Australian bee families and genera (even many species) is possible with this book. Under each family, Terry provides comprehensive taxonomic, ecological and behavioural information for subfamilies, tribes, genera and many species. Etymologies, the Greek or Latin derivations for many of the scientific names, are provided as well as a guide on how to correctly pronounce these names. Terry lists the number of species within each genus and any known floral or nesting preferences.

This book is superbly illustrated, with only a few black and white line diagrams and a number of images of set specimens (especially used to show close-ups of diagnostic characters), but the majority are images from live specimens which show many behavioural bee characteristics. I did a quick count and found about 450 such images (Part 1: 140; Part 2: 350). Of these, I found only three or four images that were at least half-page size. Most images are smallish, sometimes six or more images per page. While the bee is visible in these smaller images, their usefulness for identification purposes is reduced. I would have preferred some images to take up a full page. For example, the Laurence Sanders image of a leafcutter bee *Megachile macularis* carrying a piece of cut leaf, about to enter an underground burrow where a sizeable wolf spider is sitting at the entrance (p. 53). This discovery was the first to show a cohabitation of a bee and potential predator—why didn't the spider attack the bee? This image deserves a half or full page to allow the reader to appreciate the significance of the photo.

Finally, there is an extensive glossary of scientific terminologies used in the book.

I would thoroughly recommend this book to curious naturalists and to seasoned melittologists like me. Everyone will learn something, perhaps many new things, from Terry's 50 years of 'simply messing about with bees'.

Reference

Michener CD (2007) *The Bees of the World*. 2nd edn. (John Hopkins University Press: Baltimore)

Dr Ken Walker
Museums Victoria
GPO Box 666
Melbourne Victoria 3001

Thank you
from the Editors

The Victorian Naturalist could not be published, and would not be successful, without the tremendous effort given voluntarily by a large number of people who work behind the scenes.

As always, we particularly thank our authors, who provide us with excellent material for publication.

One of the most important editorial tasks is to have papers refereed. The Editors would like to say 'thank you', therefore, to the following people who refereed manuscripts that were published during 2018:

Eric Bird
Terry Coates
Leon Costermans
Ian Endersby
Maria Gibson
John Harris
Peter Homan
Ian Lunt
Peter Menkhorst
Michael Murphy
Gary Presland
Rob Wallis
Desley Whisson

The Victorian Naturalist publishes articles for a wide and varied audience. We have a team of dedicated proofreaders who help with the readability and expression of our articles. Our thanks in this regard go to:

Leon Costermans
Ian Endersby
Sue Forster
Maria Gibson
Pat Grey
Murray Haby
Virgil Hubregtse
Alison Jones
Angus Martin
Tom May
Michael McBain
Geoffrey Paterson
Gary Presland
Karen Retra
Rob Wallis

Sincere thanks to our book reviewers for 2018, who provided interesting and insightful comments on a wide range of books:

Andrew Christie
Leon Costermans
Scott Eipper
Sue Forster
Patrick-Jean Guay
Margaret Humphrey
Gary Presland
Stuart Rae
James van Dyke
Ken Walker

On the production side, thank you to:

Ken Bell, who prepares our annual index;
and our printers, Focus Print Group, especially Stuart Anderson and Lena Cardamon.

Guidelines for Authors—*The Victorian Naturalist*

December 2018

The Victorian Naturalist welcomes the submission of papers presenting original and significant research. When preparing a paper for publication, please follow the journal style as closely as possible.

Submission of a manuscript will be taken to mean that the material has not been published, nor is being considered for publication, elsewhere, and that all authors agree to its submission.

Authors may submit material in the form of Research Reports, Contributions, Naturalist Notes, Letters to the Editor and Book Reviews. All Research Reports and Contributions are peer reviewed by external referees. A ***Research Report*** is a succinct and original scientific paper written in a form that includes an abstract, introduction, methods, results and discussion. Research Reports should be written in the third person. A ***Contribution*** may consist of reports, comments, observations, survey results, bibliographies or other material relating to natural history. The scope of a contribution is broad in order to encourage material on a wide range of topics and in a range of styles. This allows inclusion of material that makes a contribution to our knowledge of natural history but for which the traditional format of scientific papers is not appropriate. ***Naturalist Notes*** are generally short, personal accounts of observations made in the field by anyone with an interest in natural history. These notes also may include reports on excursions and talks, where appropriate, or comment on matters relating to natural history. ***Letters to the Editor*** must be no longer than 500 words. ***Book Reviews*** are usually commissioned, but the editors also welcome enquiries from potential reviewers.

Guidelines for presentation of papers

A digitised version of the manuscript can be submitted by email or post (on a memory stick). Original artwork and photos can be withheld by the author until acceptance of the manuscript. Manuscripts should be typed, double spaced with wide margins and pages numbered. Please indicate the telephone number and email address (if available) of the author who is to receive correspondence. Submission of manuscripts should be accompanied by a covering letter.

The ***title*** should be concise, interesting and informative and not stated as a question.

Research reports and contributions must be accompanied by an ***abstract*** of not more than 150 words. The abstract should state the scope of the work, give the principal findings and be sufficiently complete for use by abstracting services.

Keywords are included following the Abstract in Contributions and Research Reports. A maximum of five terms will be used.

References are cited chronologically in the text by author and date. All references in the text must be listed at the end of the paper in alphabetical order. Entries in this list must correspond to references in the text.

A digitised version of the manuscript is required upon resubmission after referees' comments have been incorporated. Documents should be in Microsoft Word. **The bibliographic software 'EndNote' should NOT be used.**

Abbreviations

The following abbreviations should be used in the manuscript where appropriate (italicised as indicated): *et al.*; pers. obs.; unpubl. data; pers. comm. (followed by a date); 'subsp.' for subspecies.

Units

The International System of Units (SI units) should be used for exact measurement of physical quantities.

Figures and Tables

All illustrations (including photographs) are considered as figures and will be laid out to fit the width of a page (123 mm) or a column (59.5 mm) width. **It is important that the legend is clearly visible at these sizes.** Digital images should be of a sufficiently high quality and contrast to reproduce clearly (saved at **a minimum resolution of 300 dpi**). Line drawings, maps and graphs may be computer-generated or in black Indian Ink on stout white or tracing paper. The figure number and the paper's title should be written on the back of each figure in pencil. Scanned hand-drawn figures must be **a minimum resolution of 300 dpi.**

Computer-generated figures should be submitted **separately** as a high quality TIFF, encapsulated postscript (EPS) or high quality JPG files, scanned **at 300 dpi resolution** or more, and **not embedded** into a MS Word document. Low-resolution JPG files will not be accepted.

Tables must fit into a column width of 59.5 mm or 123 mm. If using a table editor, such as that in MS Word, do not use carriage returns within cells. Use tabs and not spaces when setting up columns without a table editor.

All figures and tables should be referred to in the text and numbered consecutively. Their captions (Fig. 1, Fig. 2, etc.) should be placed on a separate page at the end of the manuscript. Tables (Table 1, Table 2, etc.) should have an explanatory caption at the top.

Please consult the editors if additional details are required regarding document formats and image specifications.

Permits
Papers reporting work that required permits should quote the appropriate permit type and numbers.

Sequence data
All nucleotide sequence data and alignments should be submitted to an appropriate public database, such as Genbank or EMBL. The accession numbers for all sequences must be cited in the article.

Journal style
For further information on style, write to the editors, or consult the latest issue of *The Victorian Naturalist* or most recent edition of *Style Manual for Authors, Editors and Printers* (John Wiley & Sons: Milton, Qld).

Authors are advised to note the layout of headings, tables and illustrations as given in recent issues of the journal. A full stop is followed by a **single space**; **single quotation marks** are used throughout.

In all papers, first reference to a species should use both the common name and binomial. This journal uses capitalised common names for species, followed by the binomial in italics without brackets, e.g. Kangaroo Grass *Themeda triandra*. However, where many species are mentioned, a list (an appendix at the end), with both common and binomial names, may be preferred. Lists must be in taxonomic order using the order in which they appear in the references recommended below.

Quotations
Direct quotations of more than 30 words from referenced texts will be indented as a block in smaller type. Shorter quotes will be enclosed by single quotation marks at the beginning and end of the quoted passage. Page numbers are required for all quotes.

References
References in the text should cite author and year, e.g. Brown (1990), (Brown 1990), (Brown 1990, 1991), (Brown 1995 unpubl.), (Brown and Green 1990), (Brown and Green 1990; Blue 1990; Red 1990). If there are more than two authors for a paper use (Brown *et al.* 1990). All references mentioned in the text should be included, in alphabetical order, at the end of the text under **References** (see examples below). The use of unpublished data is accepted only if the data are available on request for viewing. Pers. obs. and pers. comm. should not be included in the list of references. **Journal titles should be given in full.**

Leigh J, Boden R and Briggs J (1984) *Extinct and Endangered Plants of Australia*. (Macmillan: South Melbourne)

Lunney D (1995) Bush Rat. In *The Mammals of Australia*, pp. 651-653. Ed R Strahan. (Australian Museum/Reed New Holland: Sydney)

Phillips A and Watson R (1991) *Xanthorrhoea*: consequences of 'horticultural fashion'. *The Victorian Naturalist* **108**, 130-133.

Smith AB (1995) Flowering plants in north-eastern Victoria. (Unpublished PhD thesis, The University of Melbourne)

Wolf L and Chippendale GM (1981) The natural distribution of *Eucalyptus* in Australia. Australian National Parks and Wildlife Service, Special Publications No 6, Canberra.

Other methods of referencing may be acceptable in manuscripts other than research reports, in which case the editors should be consulted.

Manuscript corrections
Page proofs are provided to the corresponding author for checking prior to publication. At this stage only minor alterations may be made.

Complimentary copies
Following publication of an article, note or book review in the journal, a PDF copy will be provided to the author(s). Printed copies of the article can be provided, on request.

Taxonomic names
Cite references used for taxonomic names. **Checking species names is the responsibility of authors.** The books we use as references for articles in *The Victorian Naturalist* are listed below. **Authors should refer to the source used for species names in their manuscripts.** In every case, the latest edition should be used.

Mammals—Menkhorst PW and Knight F (2011) *A Field Guide to the Mammals of Australia*. 3rd edn. (Oxford University Press: South Melbourne)

Reptiles and Amphibians—Cogger H (2014) *Reptiles and Amphibians of Australia*. 7th edn. (CSIRO: Collingwood, Victoria)

Insects and Marine Creatures—ABRS: <http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/index.html>

Birds—Christidis L and Boles WE (2008) *Systematics and taxonomy of Australian birds*. (CSIRO: Collingwood, Victoria)

Plants—VicFlora (2015). Flora of Victoria, Royal Botanic Gardens Melbourne, <http://data.rbg.vic.gov.au/vicflora>, last accessed (insert relevant date).

Please submit manuscripts and enquiries to:
The Editor
The Victorian Naturalist
PO Box 13
Blackburn, Victoria 3130

Phone +61 (03) 9877 9860
Email: vicnat@fncv.org.au
Web: www.fncv.org.au

PHASCOLOMYS WOMBAT, *Per et Les*